PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-054673
(43)Date of publication of application : 26.02.1999

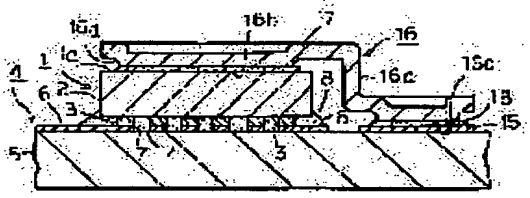
(51)Int.CI. H01L 23/36

(21)Application number : 09-205561
(22)Date of filing : 31.07.1997

(71)Applicant : NEC KANSAI LTD
(72)Inventor : HINO JIICHI

(54) SEMICONDUCTOR DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To realize a semiconductor device of flip chip structure which is thin, small-sized and capable of large power operation, by connecting a rear electrode through which a main current of a power transistor pellet flows with a wiring board, by using a thermoelectric connection member of low resistance which is free from self heat generation and excellent in thermal conduction.
SOLUTION: Bump electrodes 3 and a rear electrode 1a are formed on both surfaces of a semiconductor pellet 1. Fine pad electrodes 7 and a large diameter pad electrode 15 to which a main current is supplied are formed on a wiring board 4. In this device, the bump electrodes 3 and the fine pad electrodes 7 are overlapped and made to face each other. Overlapping parts of the respective electrodes are electrically connected. The rear electrode 1a and the large diameter pad electrode 15 are connected with a thermoelectric connection member 16 having thermally and electrically excellent conductivity, via adhesive materials 17, 18 having thermally and electrically excellent conductivity.



LEGAL STATUS

[Date of request for examination] 07.12.2000
[Date of sending the examiner's decision of rejection] 18.08.2003
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]

(19)日本国特許庁（ＪＰ）　(12)公開特許公報（Ａ）　(11)特許出願公開番号

特開平11－54673

(43)公開日　平成11年(1999)２月26日

(51)Int.Cl.[6]	識別記号	ＦＩ	
Ｈ０１Ｌ　23/36		Ｈ０１Ｌ　23/36	Ｄ

審査請求　未請求　請求項の数７　ＯＬ　（全５頁）

(21)出願番号　特願平9－205561

(22)出願日　平成９年(1997)７月31日

(71)出願人　000156950
関西日本電気株式会社
滋賀県大津市晴嵐２丁目９番１号

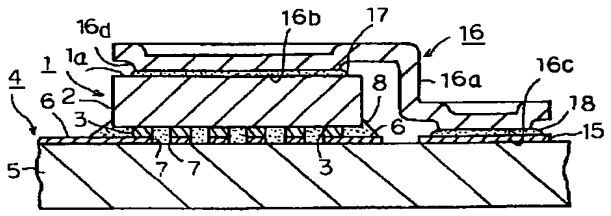
(72)発明者　樋野　滋一
滋賀県大津市晴嵐２丁目９番１号　関西日本電気株式会社内

(54)【発明の名称】　半導体装置

(57)【要約】

【課題】従来のフリップチップ構造の半導体装置では熱的、電気的に大電力動作させることが困難であった。

【解決手段】バンプ電極３と裏面電極１ａとを両面に形成した半導体ペレット１と、微小パッド電極７と主電流が供給される径大パッド電極１５とを形成した配線基板４とを、バンプ電極３と微小パッド電極７とを重合させて対向させ各電極の重合部を電気的に接続するとともに、背面電極１ａと径大パッド電極１５間を、熱的、電気的に良好な伝導性を有する接着材１７、１８を介して熱的、電気的に良好な伝導性を有する熱電気接続部材１６に接続したことを特徴とする半導体装置。



1

【特許請求の範囲】

【請求項１】一主面にバンプ電極を形成し他の主面に裏面電極を形成した半導体ペレットと、半導体ペレットのバンプ電極に対応する位置に微小パッド電極を形成するとともに微小パッド電極形成領域の外方に主電流が供給される径大パッド電極を形成した配線基板とを、バンプ電極と微小パッド電極とを重合させて対向させ各電極の重合部を電気的に接続するとともに、半導体ペレットの他の主面と径大パッド電極間を、熱的、電気的に良好な伝導性を有する接着材を介して熱的、電気的に良好な伝導性を有する熱電気接続部材に接続したことを特徴とする半導体装置。

【請求項２】熱電気接続部材の半導体ペレットと接続される部分に接着材の厚みを規制する突起を設けたことを特徴とする請求項１に記載の半導体装置。

【請求項３】熱電気接続部材の半導体ペレットと接続される部分に余剰の接着材を逃がす穴または溝を形成したことを特徴とする請求項１に記載の半導体装置。

【請求項４】肉薄部と肉厚部とを隣接させた金属板にて熱電気接続部材を構成し、肉薄部を半導体ペレットの他の主面と、肉厚部を配線基板の径大パッド電極とそれぞれ対向させ、接着材を介して電気的に接続したことを特徴とする請求項１に記載の半導体装置。

【請求項５】熱電気接続部材の外面に凹凸を形成したことを特徴とする請求項４に記載の半導体装置。

【請求項６】熱電気接続部材が銅またはアルミニウムからなり、接着材と接触する部分が接着材に対して濡れ性の良好な面に形成されたことを特徴する請求項１に記載の半導体装置。

【請求項７】熱電気接続部材の接着材との接触部を除く部分が絶縁被覆されたことを特徴する請求項１に記載の半導体装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明はフリップチップ構造の半導体装置に関し、特に大電流動作する半導体ペレットを具えた半導体装置に関する。

【０００２】

【従来の技術】電子回路装置は、配線基板に小型の電子部品を高密度実装し、装置の小型化と高機能、高性能化を実現している。この小型の電子部品の一例を図６から説明する。図において、１は半導体ペレットで、内部に多数の半導体素子（図示せず）を形成した半導体基板２の一主面に多数のバンプ電極３を形成している。４は配線基板で、樹脂やセラミクスなどの絶縁部材よりなる絶縁基板５に導電パターン６を形成し、この導電パターン６の一部で半導体ペレット１のバンプ電極３と対向する部分にパッド電極７を形成している。この半導体ペレット１と配線基板４とはバンプ電極３とパッド電極７とが重合するように対向配置され、各電極３、７は熱圧着や

2

溶融接続により電気的に接続される。８は半導体ペレット１と配線基板４とを機械的に接続し半導体ペレット１表面の配線パターン（図示せず）を外部の腐食性ガスから保護する接着用樹脂を示す。この種半導体装置は、半導体ペレット１として高密度集積されたものを用いることにより、小型で薄い電子部品を実現できる。またこの種半導体装置は、半導体ペレット１としてマイクロプロセッサを用い、配線基板４の図外領域に、メモリや入出力インターフェースなどの周辺電子部品をマウントすることにより、配線基板４の単位で電子回路装置を構成することもできる。ところで、半導体ペレット１は小信号用のものでは、図示例のように一主面にバンプ電極３を集中させることができる。一方、大電流を取り扱う半導体ペレットでは、微小なバンプ電極に大電流が集中すると電極部分や電極の重合部を損傷するため、複数のバンプ電極を並列接続して電流を分散させ電流容量を増大させている。また、電力用のトランジスタやＦＥＴなどを含み、両面に主電流が流れる電極を形成した半導体ペレットでは、バンプ電極側の主電流電極とともに他の面（裏面）の主電流電極を、それぞれ配線基板の導電パターンに接続する必要がある。そのため裏面電極と配線基板とをワイヤボンディングすることが考えられるが、ワイヤによる接続はワイヤの立ち上がり部分の高さ分だけ半導体装置の厚さが厚くなり、小型化、薄型化の目的に反する。このような問題を解決するものとして、特表平７－５０３５７９号公報には図７に示すように、半導体ペレット１にスパッタ金属フィルム９を、その導電面の中央部を半導体ペレット１の裏面電極１ａに当接させ、周縁部を配線基板４上の導電パターン１０に当接させて、それぞれの当接面を電気的に接続した構造の半導体装置が開示されている。また、米国特許第５、５８６、０１０号明細書には、図８に示すように矩形穴１１ａを有する絶縁基板１１の一方の面に導電層１２を形成し、この導電層１２を矩形穴１１ａ部分で中央部が平坦なドーム状に成形して、このドーム状成形部１２ａに肉厚の支持部材１３を固定し、さらにこの支持部材１３に半導体ペレット１４を固定した構造の半導体装置が開示されている。上記図７半導体装置は半導体ペレット１の裏面電極１ａを配線基板４に電気的に接続し、図８半導体装置はバンプ電極を有する半導体ペレットではないが、半導体ペレット１４が発生する熱を支持部材１３と導電層１２に伝達し、さらに導電層１２から絶縁基板１１に伝達して、半導体ペレット１４を冷却するものである。これらはいずれも、半導体ペレット１、１４の裏面電極を配線基板４、１１に接続することができ、薄型の半導体装置に好適である。

【０００３】

【発明が解決しようとする課題】しかしながら、図７、図８に示す半導体装置はいずれも、熱および電流の通過断面積が極めて小さい導電膜によって半導体ペレットの

裏面電極と配線基板との間の接続が行われるため、熱伝導量が小さく、放熱性が実質的に支持部材１３で決定され、導電膜の許容電流で半導体装置の動作電流が制限されるという問題があった。即ち、半導体ペレットは動作開始すると室温状態から温度上昇し、この半導体ペレットと熱的に密着した導電膜の電気抵抗も温度上昇とともに増大する。導電膜材料が例えば銅の場合、その電気抵抗は２０℃で１．７２Ω・ｍであるのに対し、１００℃では２．２８Ω・ｍとなり３３％増大し、自己発熱量も増大して周囲温度より高くなり半導体ペレットからの熱の流入を阻止し、熱的、電気的抵抗が増大するため半導体ペレットからの電流が低下し出力が低下する。そのため、図７、図８に示す構造の半導体は大電流で連続的に動作するモータなどの駆動制御用半導体装置には適用しにくく、適用するとしてもブロアなどの冷却手段が必要で装置全体の小型化は困難であった。

【０００４】

【課題を解決するための手段】本発明は上記課題の解決を目的として提案されたもので、一方の面にバンプ電極を他の面に裏面電極をそれぞれ形成した半導体ペレットを、微小パッド電極と径大パッド電極とをそれぞれ形成した配線基板に、バンプ電極と微小パッド電極とを重合させて対向させ各電極の重合部を電気的に接続するとともに、半導体ペレットの他の面に形成した裏面電極と径大パッド電極間を、熱的、電気的に良好な伝導性を有する接着材を介して熱的、電気的に良好な伝導性を有する熱電気接続部材に接続したことを特徴とする半導体装置を提供する。

【０００５】

【発明の実施の形態】本発明による半導体装置は、半導体ペレットの裏面電極と径大パッド電極間を、熱的、電気的に良好な伝導性を有する接着材を介して熱的、電気的に良好な伝導性を有する熱電気接続部材に接続したことを特徴とするが、熱電気接続部材の半導体ペレットと接続される部分に接着材の厚みを規制する第１の突起を設けることにより、半導体ペレットのオンオフ動作の繰り返しによる温度上昇、低下その結果としての熱膨張、収縮による半導体ペレットと接着材間に生じる応力を緩和させることができる。また、熱電気接続部材の半導体ペレットと接続される部分に余剰の接着材を逃がす穴または溝を形成することもできる。これにより余剰の接着材が半導体ペレットの側壁など不所望部分に広がり付着するのを防止でき、接着材の厚みのばらつきを抑えることができる。また肉薄部と肉厚部とを隣接させた金属板にて熱電気接続部材を構成し、肉薄部を半導体ペレットの他の主面と、肉厚部を配線基板の径大パッド電極とそれぞれ対向させ、接着材を介して電気的に接続することにより、放熱性が良好で組立性の良い半導体装置を実現できる。この場合、熱電気接続部材の外面に凹凸を形成し、表面積を増大させ放熱効果を向上させることができる。熱電気接続部材は熱的、電気的に良好な伝導性を有する材料を用いられるが、具体的には加工性も良好な銅またはアルミニウムが好適で、接着材と接触する部分は接着材に対して濡れ性の良好な面に形成される。熱電気接続部材が半導体ペレットの充電部に接続される場合には、熱電気接続部材の接着材との接触部を除く部分を予め絶縁被覆しておくことが好ましい。

【０００６】

【実施例】以下に本発明の実施例を図１から説明する。図において、図６と同一物には同一符号を付して重複する説明を省略する。本発明による半導体装置が図６半導体装置と相違する点を説明する。即ち、半導体ペレット１は一方の面にバンプ電極３が形成され、他の面には主電流が流れる裏面電極１ａが形成されている。配線基板４は、絶縁基板５上の半導体ペレット１に形成されたバンプ電極３と対向する位置にバンプ電極３とほぼ同じ大きさの径小パッド電極７が形成され、このパッド電極３の形成領域の外方にパッド電極７に比して十分大きな径大パッド電極１５を形成している。１６は熱的、電気的に良好な伝導性を有する銅などの金属平板をその両端部が平行となるように中間部を折り曲げて段差を設けた熱電気接続部材で、段差部分１６ａで隣り合う平面部１６ｂ、１６ｃを半導体ペレット１の裏面電極１ａ、径大パッド電極１５にそれぞれ対向させている。段差部１６ａは、半導体ペレット１の厚さ、バンプ電極３及びパッド電極７、１５の高さ、接着材１７、１８の厚みなどが考慮され設定される。１７、１８はそれぞれ熱的、電気的に良好な伝導性を有する半田や導電ペーストなどの接着材で、熱電気接続部材１６を半導体ペレット１の裏面電極１ａ、径大パッド電極１５にそれぞれ接続する。この半導体装置は、複数のパッド電極が裏面電極１ａに対応して主電流が供給され、半導体ペレット１の大電流動作を可能にしている。熱電気接続部材１６は半導体ペレット１の厚さの１／３以上あればよく、例えば厚さ１００μｍとし、巾を半導体ペレット１の一辺の長さとほぼ同じ巾、例えば１５ｍｍとすることにより、図７、図８に示す装置で導電膜の厚さが最大でも３０μｍ程度しかできないことに比較して、熱的、電気的通過断面積を格段に大きくできる。図１実施例では、熱電気接続部材１６の接着部分をエンボス加工し３０μｍ程度突出させ、この突出部１６ｄの一辺の長さを半導体ペレット１の一辺の長さの９０％程度に設定している。これにより、突出部１６ｄからはみ出した余剰の接着材１７は突出部１６ｄの周縁に留まり、半導体ペレット１からはみ出さず、配線基板４上への流出が防止できる。また、図１実施例では、熱電気接続部材１６の突出部１６ｄを半導体ペレット１の裏面電極１ａとほぼ同じ面積に設定したが、図２に示すように、半導体ペレット１の面積に比して十分小さい微小突起１６ｅを形成することもできる。この微小突起１６ｅは直径１ｍｍ程度で高さ５０～１００μｍ

5

程度に設定され、その下端は接着材１７を突き抜けて半導体ペレットの裏面電極１ａに当接している。半導体ペレット１はオンオフ動作を繰り返すことによって、温度上昇、温度低下するが、微小突起１６ｅにより接着材１７の厚さを上記範囲に規制することにより半導体ペレット１、接着材１７、熱電気接続部材１６のそれぞれ熱膨張率の異なる接合界面にかかる応力を緩和し接合界面にクラックが発生するのを抑制し長時間動作の可能な半導体装置を実現できる。図３は本発明の他の実施例を示す。この実施例では熱電気接続部材１６に接着材１７の余剰分を逃がす穴１６ｆを貫通している。これにより、接着材１７の内、塗付領域中央の接着材を逃がし穴１６ｆ内に収容し、接着材１７のはみ出しを効果的に防止できる。この逃がし穴１６ｆは貫通穴だけでなく、両端が側壁に開口した溝でもよい。図４は本発明の他の実施例を示す。図１乃至図３実施例は金属平板を屈曲して熱電気接続構体１６を形成したが、この実施例では、肉厚の金属平板の中間部乃至一側方に切削、ロール加工、プレス加工などの手段により肉薄部１９ａを形成し、この肉薄部１９ａに上面が面一となるように肉厚部１９ｂを隣接させた熱電気接続部材１９を用いている。この実施例では、半導体ペレット１で発生した熱は、肉薄部１９ａから半導体ペレット１と隣接する部分で肉厚部１９ｂに伝達されるため、図１実施例に比較しても段差部１６ａの長さ分、実質的に熱伝達経路を短縮でき、しかも肉厚部１９ｂは断面積が広いため、熱抵抗、電気抵抗ともに小さくでき、フリップチップ構造で大電力動作が可能な半導体装置を実現できる。この実施例に図２、図３にて説明した微小突起（１６ｅ）、逃がし穴（１６ｆ）を適用することによりそれぞれの有する効果を奏することができる。また図５に示すように熱電気接続部材１９の上面に多数の溝１９ｃを形成し、表面積を増大させて放熱性を向上させることもできる。上記それぞれの実施例において、熱電気接続部材１６、１９の具体的材料として銅を示したが、電気抵抗はやや高くなるものの軽量で加工性の良好なアルミニウムを用いることもできる。この場合、接着材１７、１８が接続される部分に、蒸着や溶射メッキなどの手段により銅や金、銀、半田、銀ロウなど接着性の良好な金属や合金の層を形成すればよい。また、熱電気接続部材１６、１９が高電位部分に接続されて用いられ、触れると感電の虞がある場合には、この熱電気接続部材１６、１９の外面を絶縁被覆することもできる。この場合、静電塗装法などの手段により熱電気接続部材１６、１９の全面に樹脂層を形成し、接着材１７、１８が接続される部分にサンドブラストや切削により樹脂層に窓明けして熱電気接続部材の素地を露出させればよい。またこの窓明け部分に蒸着、溶射メッキなどにより熱的、電気的に接着性の良好な層を形成しても良い。また図１乃至図４の実施例では、熱電気接続部材１６、１９を半導体ペレット１の裏面からその一側方に延在させた構造を示したが、半導体ペレット１に跨って周縁を半導体ペレット１を囲む位置に延在させてもよい。

6

【０００７】

【発明の効果】以上のように本発明によれば、電力用半導体ペレットの主電流が流れる裏面電極と配線基板とを低抵抗で自己発熱がなく、熱伝導性の良好な熱電気接続部材にて接続したから、薄く小型で大電力動作可能なフリップチップ構造の半導体装置を実現できる。

【図面の簡単な説明】

【図１】　本発明による半導体装置の実施例を示す側断面図

【図２】　図１実施例の変形例を示す要部側断面図

【図３】　図１実施例の他の変形例を示す要部側断面図

【図４】　本発明による半導体装置の他の実施例を示す側断面図

【図５】　図４実施例の変形例を示す側断面図

【図６】　フリップチップ構造の半導体装置を示す側断面図

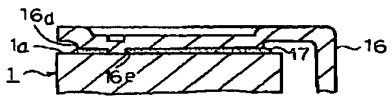
【図７】　裏面電極と配線基板とを電気的に接続した半導体装置を示す側断面図

【図８】　半導体ペレットの放熱性を改善した半導体装置を示す側断面図

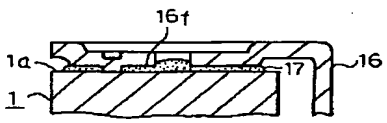
【符号の説明】

１　半導体ペレット
１ａ　裏面電極
３　バンプ電極
４　配線基板
７　微小パッド電極
１５　径大パッド電極
１６　熱電気接続部材
１７　接着材
１８　接着材
１９　熱電気接続部材

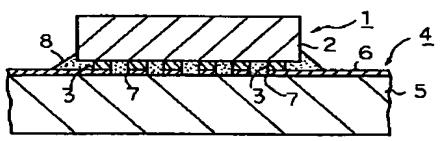
【図２】



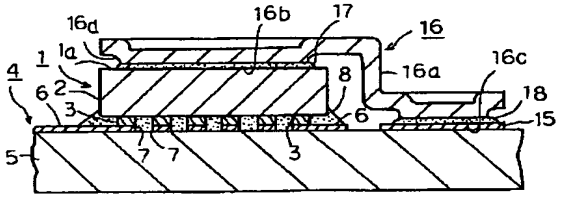
【図３】



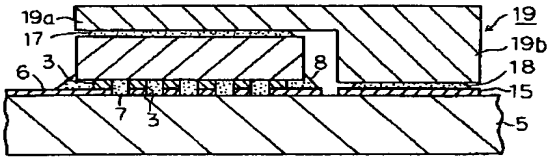
【図６】



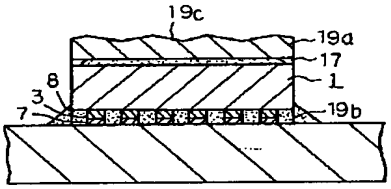
【図１】


16d
16b
17
16
1a
1
4
6
2
3
8
16a
16c
18
15
6
5
7
7
3

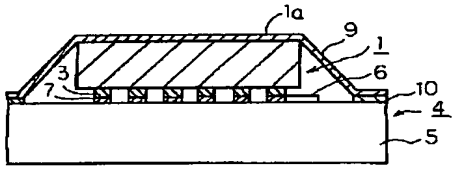
【図４】


19a
19
17
19b
6
3
8
18
15
7
3
5

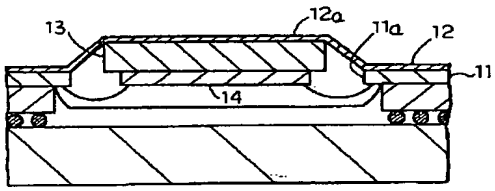
【図５】


19c
19a
17
8
3
1
7
19b

【図７】


1a
9
1
3
6
7
10
4
5

【図８】


13
12a
11a
12
11
14

Computer Translation of JP11-054673

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] Especially this invention relates to the semiconductor device equipped with the semi-conductor pellet which carries out high current actuation about the semiconductor device of flip chip structure.
[0002]
[Description of the Prior Art] Electronic-circuitry equipment carried out high density assembly of the small electronic parts to the wiring substrate, and has realized miniaturization of equipment, and high efficiency and high-performance-izing. An example of these small electronic parts is explained fromdrawing 6 . In drawing, 1 is a semi-conductor pellet and forms many bump electrodes 3 in one principal plane of the semi-conductor substrate 2 in which many semiconductor devices (not shown) were formed inside. 4 is a wiring substrate, forms the electric conduction pattern 6 in the insulating substrate 5 which consists of insulating members, such as resin and ceramics, and forms the pad electrode 7 in the bump electrode 3 of the semi-conductor pellet 1, and the part which counters with a part of this electric conduction pattern 6. Opposite arrangement is carried out so that the bump electrode 3 and the pad electrode 7 may carry out the polymerization of this semi-conductor pellet 1 and the wiring substrate 4, and each electrodes 3 and 7 are electrically connected by thermocompression bonding or melting connection. 8 shows the resin for adhesion which connects mechanically the semi-conductor pellet 1 and the wiring substrate 4, and protects the circuit pattern (not shown) of semi-conductor pellet 1 front face from external corrosive gas. This seed semiconductor device can realize small and thin electronic parts by using that by which high density accumulation was carried out as a semi-conductor pellet 1. Moreover, this seed semiconductor device can also constitute electronic-circuitry equipment from a unit of the wiring substrate 4 by mounting circumference electronic parts, such as memory and an input/output interface, on the field outside drawing of the wiring substrate 4, using a microprocessor as a semi-conductor pellet 1. By the way, the semi-conductor pellet 1 can centralize the bump electrode 3 on one principal plane like the example of illustration in the thing for small signals. On the other hand, with the semi-conductor pellet which deals with a high current, since the polymerization section of an electrode section or an electrode will be damaged if a high current concentrates on a minute bump electrode, parallel connection of two or more bump electrodes is carried out, a current is distributed, and current capacity is increased. Moreover, it is necessary including a transistor, FET, etc. for power to connect the principal current electrode of other fields (rear face) to the electric conduction pattern of a wiring substrate with the principal current electrode by the side of a bump electrode, respectively with the semi-conductor pellet in which the electrode with which principal current flows was formed to both sides. Therefore, although it is possible to carry out wirebonding of a rear-face electrode and the wiring substrate, the thickness of a semiconductor device becomes thick by the height of the standup part of a wire, and the connection with a wire is contrary to the purpose of a miniaturization and thin-shape-izing. As what solves such a problem, as shown in the Patent

Publication Heisei No. 503579 [seven to] official report at drawing 7 , contact the semi-conductor pellet 1 in the spatter metal film 9, make the center section of the electric conduction side contact rear-face electrode 1a of the semi-conductor pellet 1, the periphery section is made to contact the electric conduction pattern 10 on the wiring substrate 4, and the semiconductor device of structure which connected each contact side electrically is indicated. Moreover, the semiconductor device of the structure which formed the conductive layer 12 in one [which has rectangle hole 11a] field of an insulating substrate 11 as shown in the United States patent No. 5,586,010 specification at drawing 8 , fabricated this conductive layer 12 in the rectangle hole 11a part in the shape of [with a flat center section] a dome, fixed the thick supporter material 13 to this dome-like shaping section 12a, and fixed the semi-conductor pellet 14 to this supporter material 13 further is indicated. The above-mentioned drawing 7 semiconductor device connects electrically rear-face electrode 1a of the semi-conductor pellet 1 to the wiring substrate 4, and although the drawing 8 semiconductor device is not the semi-conductor pellet which has a bump electrode, it transmits the heat which the semi-conductor pellet 14 generates to the supporter material 13 and a conductive layer 12, transmits it to an insulating substrate 11 from a conductive layer 12 further, and cools the semi-conductor pellet 14. Each of these can connect the rear-face electrode of the semi-conductor pellets 1 and 14 to the wiring substrates 4 and 11, and is suitable for a thin semiconductor device.

[0003]

[Problem(s) to be Solved by the Invention] However, since connection between the rear-face electrode of a semi-conductor pellet and a wiring substrate was made with the electric conduction film with very small heat and passage cross section of a current, the amount of heat conduction was small, heat dissipation nature was substantially determined by the supporter material 13, and each semiconductor device shown in drawing 7 and drawing 8 had the problem that the operating current of a semiconductor device was restricted by the allowable current of the electric conduction film. That is, the electric resistance of the electric conduction film which carried out the temperature rise from the room temperature condition and which was thermally stuck with this semi-conductor pellet when the semi-conductor pellet carried out initiation of operation also increases with a temperature rise. When an electric conduction film ingredient is copper, since become 2.28 ohm-m at 100 degrees C to the electric resistance being 1.72 ohm-m at 20 degrees C, and increase 33%, self-calorific value also increases, it becomes higher than ambient temperature, the inflow of the heat from a semi-conductor pellet is prevented and thermal and electric resistance increases, the current from a semi-conductor pellet falls, and an output declines. Therefore, though it was hard to apply the semi-conductor of the structure shown in drawing 7 and drawing 8 to semiconductor devices for drive control, such as a motor which operates continuously, and it was applied by the high current, cooling means, such as Blois, were required and the miniaturization of the whole equipment was difficult.

[0004]

[Means for Solving the Problem] This invention the semi-conductor pellet which was proposed for the purpose of solution of the above-mentioned technical problem, formed the bump electrode in one field and formed the rear-face electrode in other fields, respectively While carrying out the polymerization of a bump electrode and the minute pad electrode to the wiring substrate which formed the minute pad electrode and the path size pad electrode, respectively,

making it counter and connecting the polymerization section of each electrode to it electrically The semiconductor device characterized by connecting with the thermoelectricity connection member which has good conductivity thermally and electrically through the binder which has good conductivity for the rear-face electrode and the path size pad inter-electrode which were formed in other fields of a semi-conductor pellet thermally and electrically is offered.

[0005]

[Embodiment of the Invention] Although characterized by connecting the semiconductor device by this invention to the thermoelectricity connection member which has good conductivity thermally and electrically through the rear-face electrode of a semi-conductor pellet, and the binder which has good conductivity for path size pad inter-electrode thermally and electrically By preparing the 1st projection which regulates the thickness of a binder into the part connected with the semi-conductor pellet of a thermoelectricity connection member the temperature rise by the repeat of the on-off control action of a semi-conductor pellet, and a fall -- consequently -- ** -- the thermal expansion to carry out and the stress produced between the semi-conductor pellet by contraction and a binder can be made to ease Moreover, the hole or slot which misses an excessive binder into the part connected with the semi-conductor pellet of a thermoelectricity connection member can also be formed. An excessive binder can prevent carrying out breadth adhesion into non-wanted parts, such as a side attachment wall of a semi-conductor pellet, by this, and dispersion in the thickness of a binder can be suppressed. Moreover, by constituting a thermoelectricity connection member from a metal plate which the closing-in section and the thick section were made to adjoin, making other principal planes of a semi-conductor pellet, and the thick section counter with the path size pad electrode of a wiring substrate, respectively, and connecting the closing-in section electrically through a binder, heat dissipation nature is good and can realize the good semiconductor device of assembly nature. In this case, irregularity can be formed in the external surface of a thermoelectricity connection member, surface area can be increased, and the heat dissipation effectiveness can be raised. Although the ingredient which has good conductivity thermally [a thermoelectricity connection member] and electrically is used, good copper or aluminum is specifically suitable also for workability, and the part in contact with a binder is formed in a wettability good field to a binder. When a thermoelectricity connection member is connected to the live part of a semi-conductor pellet, it is desirable to carry out pre-insulation of the part except the contact section with the binder of a thermoelectricity connection member beforehand.

[0006]

[Example] The example of this invention is explained from drawing 1 below. In drawing, the explanation which gives the same sign to the same object as drawing 6 , and overlaps is omitted. The point that the semiconductor device by this invention is different from the drawing 6 semiconductor device is explained. Namely, the bump electrode 3 is formed in one field, and, as for the semi-conductor pellet 1, rear-face electrode 1a to which principal current flows is formed in other fields. The bump electrode 3 and the **** pad electrode 7 of the almost same magnitude are formed in the bump electrode 3 formed in the semi-conductor pellet 1 on an insulating substrate 5, and the location which counters, and the wiring substrate 4 forms the sufficiently big path size pad electrode 15 in a way in it as compared with the pad electrode 7 outside the formation field of this pad electrode 3. 16 is making the flat-surface sections 16b and 16c which

are the thermoelectricity connection members which bent pars intermedia and prepared the level difference so that the both ends may become parallel about metal plates, such as copper which has good conductivity thermally and electrically, and adjoin each other by level difference partial 16a counter rear-face electrode 1a of the semi-conductor pellet 1, and the path size pad electrode 15, respectively. The height of the thickness of the semi-conductor pellet 1, the bump electrode 3, and the pad electrodes 7 and 15, the thickness of binders 17 and 18, etc. are taken into consideration, and level difference section 16a is set up. 17 and 18 are binders which have good conductivity thermally and electrically, such as solder and conductive paste, respectively, and connect the thermoelectricity connection member 16 to rear-face electrode 1a of the semi-conductor pellet 1, and the path size pad electrode 15, respectively. Corresponding to rear-face electrode 1a, principal current is supplied for two or more pad electrodes, and this semiconductor device enables high current actuation of the semi-conductor pellet 1. by making the thermoelectricity connection member 16 into 100 micrometers in thickness, and making width into the almost same width as die length of one side of the semi-conductor pellet 1, for example, 15mm, that there should just be 1/3 more than thickness of the semi-conductor pellet 1, as compared with only about 30 micrometers of thickness of the electric conduction film not being made at the maximum with the equipment shown in drawing 7 and drawing 8 , the thermal and electric passage cross section is boiled markedly, and can be enlarged. In the drawing 1 example, carried out embossing of the part for jointing of the thermoelectricity connection member 16, about 30 micrometers was made to project, and die length of one side of 16d of this lobe is set to about 90% of die length of one side of the semi-conductor pellet 1. Thereby, the binder 17 of the surplus protruded from 16d of lobes stops at the periphery of 16d of lobes, and is not protruded from the semi-conductor pellet 1, but can prevent the outflow of a up to [the wiring substrate 4]. Moreover, in the drawing 1 example, although 16d of lobes of the thermoelectricity connection member 16 was set as the almost same area as rear-face electrode 1a of the semi-conductor pellet 1, as shown in drawing 2 R> 2, as compared with the area of the semi-conductor pellet 1, sufficiently small minute projection 16e can also be formed. This minute projection 16e was set as height of about 50-100 micrometers for the diameter of about 1mm, and that lower limit ran through the binder 17, and is in contact with rear-face electrode 1a of a semi-conductor pellet. By repeating on-off control action, the semi-conductor pellet 1 controls that ease the stress which is applied to a temperature rise, and is applied to the junction interface of the semi-conductor pellet 1, a binder 17, and the thermoelectricity connection member 16 from which coefficient of thermal expansion differs, respectively by regulating the thickness of a binder 17 in the above-mentioned range by minute projection 16e although a temperature fall is carried out, and a crack occurs in a junction interface, and can realize the possible semiconductor device of long duration actuation. Drawing 3 shows other examples of this invention. In this example, 16f of holes which miss a part for the surplus of a binder 17 to the thermoelectricity connection member 16 is penetrated. Thereby, the binder of the center of a field with ** is held in 16f of spill ports among binders 17, and the flash of a binder 17 can be prevented effectively. The slot as for which not only a through hole but both ends carried out opening to the side attachment wall is sufficient as 16f of this spill port. Drawing 4 shows other examples of this invention. Although drawing 1 thru/or the drawing 3 example were crooked in the metal plate and the thermoelectricity connection structure 16 was formed, in this example, closing-in section 19a is formed in the pars

intermedia of a thick metal plate thru/or the 1 side with means, such as cutting, roll processing, and press working of sheet metal, and the thermoelectricity connection member 19 which thick section 19b was made to adjoin so that a top face may become flat-tapped at this closing-in section 19a is used. in this example , since the heat generated with the semi-conductor pellet 1 be transmit to thick section 19b in the part which adjoin the semi-conductor pellet 1 from closing in section 19a , even if it compare with the drawing 1 example , a heat transfer path can be shorten on a part for the die length of level difference section 16a , and a real target , and moreover , since a cross-sectional area be large , thick section 19b can do thermal resistance and electric resistance small , and can realize the semiconductor device in which large power actuation be possible with flip chip structure . Each effectiveness which it has can be done so by applying the minute projection (16e) and spill port (16f) which were explained by drawing 2 and drawing 3 to this example. Moreover, as shown in drawing 5 , much slot 19c can be formed in the top face of the thermoelectricity connection member 19, surface area can be increased, and heat dissipation nature can also be raised. In the example of each above, although copper was shown as a concrete ingredient of the thermoelectricity connection members 16 and 19, although electric resistance becomes a little high, it can also use aluminum with good workability by the light weight. In this case, what is necessary is just to form the layer of adhesive good metals, such as copper metallurgy, silver, solder, and silver solder, or an alloy in the part to which binders 17 and 18 are connected with means, such as vacuum evaporationo and thermal-spraying plating. Moreover, when it connects with a high potential part, and the thermoelectricity connection members 16 and 19 are used, and touch and there is fear of electrification, pre-insulation of the external surface of these thermoelectricity connection members 16 and 19 can also be carried out. In this case, what is necessary is to form a resin layer all over the thermoelectricity connection members 16 and 19 with means, such as electrostatic spray painting, to carry out aperture dawn to the part to which binders 17 and 18 are connected by sandblasting or cutting at a resin layer, and just to expose the base of a thermoelectricity connection member. Moreover, an adhesive good layer may be formed in this aperture dawn part thermally and electrically by vacuum evaporationo, thermal-spraying plating, etc. Moreover, although the example of drawing 1 thru/or drawing 4 showed the structure where the thermoelectricity connection members 16 and 19 were made to extend in the 1 side from the rear face of the semi-conductor pellet 1, a periphery may be made to extend in the location surrounding the semi-conductor pellet 1 ranging over the semi-conductor pellet 1.

[0007]

[Effect of the Invention] Since there is no self-generation of heat at low resistance and the rear-face electrode and wiring substrate with which the principal current of the semi-conductor pellet for power flows were connected in the thermally conductive good thermoelectricity connection member according to this invention as mentioned above, the semiconductor device of the flip chip structure in which large power actuation is it is thin and small and possible is realizable.